120

AF/2856

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TRANSMITTAL FORM (to be used for all correspondence after initial filing)		
	Application Number	09/925,021
	Filing Date	August 9, 2001
	First Named Inventor	SAKAII
	Group Art Unit	2856
	Examiner Name	J. CHAPMAN JR.
	Attorney Docket Number	01-186

ENCLOSURES ***(check all that apply)***

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [ ] Amendment / Response
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Assignment Papers *(for an Application)*
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition Routing Slip (PTO/SB/69) and Accompanying Petition
- [ ] To Convert a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Small Entity Statement
- [ ] Request of Refund
- [ ] After Allowance Communication to Group
- [ ] Appeal Communication to Board of Appeals and Interferences
- [x] Appeal Communication to Group (Appeal Brief with Appendix)
- [ ] Proprietary Information
- [ ] Status Letter
- [ ] Additional Enclosure(s) *(please identify below):*

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm name	**Posz & Bethards, PLC**
Individual name	David G. Posz
Registration No.	37,701
Signature	DGP
Date	November 24, 2003

PTO/SB/17 (01-03)
Approved for use through 04/30/2003. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

☐ Applicant Claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 330

NOV 2 4 2003

Complete if Known	
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Filing Date	August 9, 2001
First Named Inventor	SAKAI
Examiner Name	J. CHAPMAN JR.
Art Unit	2856
Attorney Docket No.	01-186

METHOD OF PAYMENT (*check all that apply*)

☒ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☐ Deposit Account

Deposit Account Number: 50-1147

Deposit Account Name: POSZ & BETHARDS, PLC

The Commissioner is authorized to: (*check all that apply*)

☐ Charge fee(s) indicated below ☒ Credit any overpayments

☒ Charge any additional fee(s) during the pendency of this application

☐ Charge fee(s) indicated below, except for the filing fee

to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($)

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20**=	0	x	18	=	0
Independent Claims		- 3**=	0	x	86	=	0
Multiple Dependent						=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	**Reissue independent claims over original patent
1205	18	2205	9	**Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0

** or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge – late filing fee or oath	
1052	50	2052	25	Surcharge – late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	330
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive – unavoidable	
1453	1,330	2453	665	Petition to revive – unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR § 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) ____________

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 330

SUBMITTED BY

Complete (*if applicable*)

Name (Print/Type)	DAVID G. POSZ	Registration No. (Attorney/Agent)	37,701	Telephone	(703) 707-9110
Signature	DGP			Date	November 24, 2003

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13/Appeal Brief P. Walker 12-4-03

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): SAKAI et al.	Atty. Dkt.: 01-186
Serial No.: 09/925,021	Group Art Unit: 2856
Filed: August 9, 2001	Examiner: J. CHAPMAN JR.
Title: SEMICONDUCTOR DYNAMIC QUANTITY SENSOR WITH MOVABLE ELECTRODE AND FIXED ELECTRODE SUPPORTED BY SUPPORT SUBSTRATE	

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Date: November 24, 2003

BRIEF ON APPEAL UNDER 37 C.F.R. § 1.192

Sir:

Appellants hereby submit their Brief on Appeal in triplicate under 37 C.F.R. § 1.192.

1. REAL PARTY IN INTEREST

The real party in interest is DENSO Corporation, the assignee by virtue of an assignment recorded at Reel/Frame 012293/0681.

2. RELATED APPEALS AND INTERFERENCES

There is no known related appeal or interference that will directly affect, that will be directly affected by, or that will have a bearing on the Board's decision on this appeal.

3. STATUS OF CLAIMS

Claims 1-4, 7-10, and 19-22 are pending in the present application and are included in the attached Appendix. Claims 1-4, 7-10, 21, and 22 have been allowed. Claims 19 and 20 have been rejected and are now being appealed. Claims 5 and 6 were canceled in the Amendment filed under 37 CFR 1.111 on March 10, 2003. Claims 11-18 were canceled in the Amendment filed under 37 CFR 1.116 on September 10, 2003. The Examiner indicated that the Amendment after Final Rejection would be entered in the Advisory Action mailed September 29, 2003.

Although the Advisory Action mailed on September 29, 2003 indicated that claims 18 and 19 were rejected, Applicants have assumed that the Examiner intended to indicate that claims 19-20 were rejected, as claim 18 was canceled during prosecution, and as claims 19-20 are the only remaining pending claims that have not been allowed or canceled.

4. STATUS OF AMENDMENTS

All amendments submitted by Applicants have been entered.

5. SUMMARY OF THE INVENTION

The present invention is generally directed towards a semiconductor dynamic quantity sensor, and more specifically a sensor having a movable electrode and a fixed electrode supported by a support substrate for detecting a dynamic quantity applied thereto based on a change in interval between the movable electrode and the fixed electrode.

In general, there is a difference in thermal expansion coefficients between the support substrate and the movable and fixed electrodes. Therefore, these parts deform differently with changes in temperature, which results in decreased sensor accuracy due to changes in

temperature. Thus, the detection interval varies with changes in temperature because of the difference in deformation of the movable and fixed electrodes. The present invention provides a way of suppressing a change in detection interval caused by a change in temperature.

FIGS. 9A and 9B show a capacitance type semiconductor acceleration sensor 100 that, for example, is used for an air bag system, an ABS system, and the like for vehicles.

As shown in FIG. 9B, the acceleration sensor 100 includes an SOI substrate 105 that is composed of a first semiconductor layer 103a having a frame shape with a through hole 102a, a second semiconductor layer (SOI layer) 103b for detecting acceleration, and an embedded oxide film 104 provided between the first and second semiconductor layers 103a, 103b. The oxide film 104 has a through hole 102b and is a thermally oxidized film having a thermal expansion coefficient approximately equal to that of single crystal silicon forming the semiconductor layers 103a, 103b.

The second semiconductor layer 103b of the SOI substrate 105 is patterned into a specific shape by forming several grooves therein that reach the embedded oxide film 104. As shown in FIG. 9A, it has a movable portion 108, a first fixed electrode cantilevered structure 109a, and a second fixed electrode cantilevered structure 109b. The movable portion 108 is composed of a rectangular weight portion 110, comb-shaped movable electrodes 111a, 11b integrally formed with the weight portion 110, and beam portions 112a, 112b and anchor portions 113a, 113b that are provided at both ends of the weight portion 110.

The beam portions 112a, 112b displace the weight portion 110 in direction X in FIG. 9A upon receiving acceleration including a component in the direction X, and restore the weight portion 110 to its initial position in accordance with disappearance of the acceleration. Thus, the

movable portion 108 can be displaced in the displacement direction (direction X) of the beam portions 112a, 112b in response to the acceleration applied thereto.

The first fixed electrode cantilevered structure 109a is composed of a first fixed electrode supporting portion 115a and a first fixed electrode 116a. The comb-shaped first fixed electrode 116a is supported by the first fixed electrode supporting portion 115a, and has a side face (detection surface) facing a side face (detection surface) of the comb-shaped movable electrode 111a in parallel with each other while defining a given detection interval therebetween.

When acceleration is applied to the acceleration sensor 100, the movable electrode 111a is displaced, and a change of the relative position between the fixed electrode 116a and the movable electrode 111a is detected as a change in capacitance between the two electrodes.

Likewise, the second fixed electrode cantilevered structure 109b is composed of a second fixed electrode supporting portion 115b and a second fixed electrode 116b. The comb-shaped second fixed electrode 116b is supported by the second fixed electrode supporting portion 115b, and faces a side face of the comb-shaped movable electrode 111b (at an opposite side of the detection interval defined by the movable electrode 111a) in parallel with each other while defining a given detection interval therebetween.

When acceleration is applied to the acceleration sensor 100, the movable electrode 111b is displaced, and a change of the relative position between the fixed electrode 116b and the movable electrode 111b is detected as a change in capacitance between the two electrodes.

Further, rectangular through holes 117 are formed in the weight portion 110, the fixed electrodes 116a, 116b, and the movable electrodes 111a, 111b, thereby providing a rigid-frame structure. Thus, the weight of the capacitance type acceleration sensor 100 is lessened

As shown in FIG. 9A, widths A1 and A2 of frame parts of the support substrate 140 (composed of the first semiconductor layer 103a), to which the anchor portions 113a, 113b of the movable portion 108 are respectively fixed, are equal to each other, i.e., satisfy a relation of A1=A2. Moreover, widths B1 and B2 of frame parts of the support substrate 140, to which the first fixed electrode supporting portion 115a and the second fixed electrode supporting portion 115b are respectively fixed, are equal to each other, i.e., satisfy a relation of B1=B2. The above widths may satisfy a relation of A1=A2 =B1=B2, or a relation of A1=A2 ≠ B1=B2.

In the present embodiment, the width of the support substrate 140 in the displacement direction X of the movable portion 108 is made uniform. However, the allowance in difference between the widths A1 and A2 of the support substrate 140 should be up to 30 μm in consideration of the processing variations such as when the through hole 102a is formed and when dicing is performed. In view of suppressing the output variation, it is preferred that the difference between the widths A1 and A2 of the support substrate 140 is 15% or less of the shorter one of A1 and A2. More preferably, the difference is 10% or less. In order to significantly reduce the output variation, the difference should be 7% or less. For example, in the present embodiment, A1 is 320 μm, and A2 is 340 μm.

Therefore, according to the present embodiment, the width of the support substrate 140 in the direction perpendicular to the displacement direction X is also made uniform (B1=B2) so that the displacement amounts of the fixed electrodes 116a, 116 become uniform. As a result, the changes of the facing areas between the movable electrodes 111a, 11b and the fixed electrodes 116a, 116b also become uniform, thereby preventing output variation. The widths B1, B2 of the support substrate 140 as well as the widths A1, A2 thereof may have a specific difference therebetween as described above.

As described above, because the movable portion 108 is supported by the support substrate 140, the deformation of the support substrate 140 is accompanied by the deformation of the movable portion 8. In the present embodiment, the displacement of the movable portion 108 becomes uniform even when the support substrate 140 deforms with the temperature change, by positioning the center of the movable portion 108 on the centerline C of the support substrate 140. As a result, the displacement of the movable electrodes 111a, 111b to the sides of the fixed electrodes 116a, 116b can be restrained. The changes of the capacitances caused by the displacements of the movable electrodes 111a, 111b can be reduced to prevent the output variation due to the temperature change.

Therefore, the present invention provides semiconductor dynamic quantity sensor that can suppress a change in detection interval caused by a change in temperature.

6. ISSUES

The issue presented for review is:

(1) Whether claims 19 and 20 are anticipated by U.S. Patent No. 6,450,031 to Sakai et al. (commonly assigned to Denso Corporation).

7. GROUPING OF THE CLAIMS

Claims 19 and 20 stand or fall together.

8. ARGUMENTS WITH RESPECT TO ISSUES PRESENTED FOR REVIEW

A. PRIOR ART SUMMARY

The cited reference will be summarized for the Board's convenience prior to arguments being presented.

(1) U.S. Patent No. 6,450,031 to Sakai et al.

Sakai et al. discloses a semiconductor physical quantity sensor from which a stable sensor output can be obtained even when the usage environment changes. A silicon thin film 7 is disposed on an insulating film 6 on a supporting substrate 5, and a bridge structure 10 having a weight part 15 and moving electrodes 16, 17 and cantilever structures 11, 12 having fixed electrodes 20, 24 are formed as separate sections from this silicon thin film. The moving electrodes 16, 17 provided on the weight part 15 and the cantilevered fixed electrodes 20, 24 are disposed facing each other. Slits 23a, 23b are formed at root portions 22 of the cantilevered fixed electrodes 20, 24 at the fixed ends thereof, and the width W1 of the root portions 22 is thereby made narrower than the width W2 of the fixed electrodes 20 proper. As a result, the transmission of warp of the supporting substrate 5 to the cantilevered fixed electrodes 20, 24 is suppressed.

Specifically, in Figure 1, Sakai et al. discloses a frame member that includes a support substrate 5 and insulating film 6. The frame member is separated from the fixed electrode supporting substrates 20/24 by two different widths. One width can be measured as the distance between the top edge of support substrate 5/insulating film 6 and fixed electrode supporting substrates 20/24 and another width can be measured as a distance between the bottom edge of support substrate 5/insulating film 6 and fixed electrode supporting substrates 20/24. The first

width (smaller width) is significantly and noticeably narrower than and the second width (larger width).

Therefore, Sakai et al. discloses a semiconductor physical quantity sensor having a large difference between a first width and a second width of the distance between the frame member and the fixed electrode supporting substrates. Sakai et al. does not, however, teach or suggest a semiconductor dynamic quantity sensor wherein a difference between a first width and a second width of the frame member is 15% or less of a shorter of the first width or the second width. Rather, Sakai et al. teaches a frame member 5 having a difference between a first width and a second width of the frame member greater than about 15% of a shorter of the first width or the second width.

B. ARGUMENTS

(1) Whether claims 19 and 20 are anticipated by Sakai et al.

Applicants submit that claims 19 and 20 are patentable as a separate group because the cited art fails to teach or suggest a frame member wherein a difference between a first width and a second width of the frame member is 15% or less of a shorter of the first width or the second width.

Since claims 19 and 20 stand or fall together, independent claim 19 will be used as an exemplary claim in the following discussion.

Claim 19 recites, *inter alia*:

> a frame member;...
> wherein a difference between a first width and a second width of the frame member is 15% or less of a shorter of the first width or the second width.

The configuration as recited in claim 19 provides for the allowance in difference between the widths A1 and A2 of the support substrate/frame member 140 in Figure 9A of the present invention to be up to 30 μm in consideration of the processing variations such as when the through hole 102a is formed and when dicing is performed. In view of suppressing the output variation, it is preferred that the difference between the widths A1 and A2 of the support substrate 140 is 15% or less of the shorter one. The configuration recited in claim 20 narrows the difference to 10% or less.

In the Final Rejection dated April 14, 2003 (hereinafter "the Final Rejection"), the Examiner rejected claims 19 and 20 (along with claims 11-18, now canceled) under 35 U.S.C. §102(e) as being anticipated by Sakai et al. Specifically, the Examiner stated that "Sakai et al. discloses a semiconductor dynamic quantity sensor in Fig. 1 comprising a square frame member 5 having a square through hole 8 formed in the middle thereof. Note column 8, lines 48-51."

However, Applicants respectfully assert that Sakai et al. does **not** disclose a frame member including two widths having a difference of 15% or less of the shorter one. The fact that the frame member 5 referred to by the Examiner is square and has a square through hole 8 is irrelevant to the issue of the "top" and "bottom" widths. Although Sakai et al. discloses a semiconductor physical quantity sensor have a frame member 5, the reference fails to disclose that the difference between the "top" and "bottom" widths is 15% or less or provide any discussion thereof. Rather, Sakai et al. discloses a frame member having a width between an edge thereof and a fixed electrode that appears to be much greater than 15% of the width between

another edge thereof and the fixed electrode. Further, Sakai et al. does not discuss the importance of the need for uniformity of the widths so that the displacement amounts of the fixed electrodes become uniform. As discussed in the present invention, as a result, the changes of the facing areas between the movable electrodes 111a, 111b and the fixed electrodes 116a, 116b also become uniform, thereby preventing output variation. Instead, Sakai et al. is merely concerned with the widths W1 of the root portions 22, 26 of fixed electrodes 20, 24 being narrower than the widths W2 of the comb-shaped fixed electrodes 20, 24 proper. In the sensor of Sakai et al. if the root portions 22, 26 of the fixed electrodes 20, 24 are too thin even the fixed electrodes 20, 24 will be displaced by the external physical quantity (acceleration) so that, relative to the moving electrodes, the fixed electrodes do not move. *See* column 10, lines 3-8.

That is, when the fixed electrodes 20, 24 move under acceleration, this appears in the sensor output as an error. It is desirable for this error to be kept to not more than 1%. In view of this, to ensure that, relative to the moving electrodes, the fixed electrodes do not move, the extent to which the root portions 22, 26 of the fixed electrodes function as springs must be negligible compared to the extent to which the suspension parts (spring parts) 14a, 14b function as springs. *See* column 10, lines 9-22.

Consequently, even when the supporting substrate 5 warps due to thermal stress or the like, because the width of each of the root portions 22, 26 of the fixed electrodes 20, 24 is narrow relative to the respective fixed electrodes 20, 24 proper, the transmission of warp of the supporting substrate 5 to the cantilevered fixed electrodes 20, 24 is suppressed. As a result, positional misalignment between the fixed electrodes 20, 24 and the moving electrodes 16, 17 is prevented and fluctuations in sensor output are suppressed. In this way, it is possible to obtain a stable sensor output even when the usage environment changes. *See* column 15, lines 3-53.

Thus, Sakai et al. obtains a stable sensor output by providing fixed electrodes having a root portion width narrower than the width of the fixed electrodes proper.

Therefore, referring specifically to the language of pending claim 19, Sakai et al. fails to show a frame member wherein a difference between a first width and a second width of the frame member is 15% or less of a shorter of the first width or the second width.

Additionally, the invention was not described in a patent by another before the invention by the applicant for patent, since the patent and the application, were at the time of the invention, commonly assigned to Denso Corporation.

In summary, Applicants respectfully submit that Sakai et al. does not show or suggest all elements of the claimed invention(s) and therefore does not anticipate claim 19 under 35 U.S.C. §102(e). Based on the comments above and in view of the evidence presented, Applicants respectfully submit that independent claim 19 and its dependent claim 20 are patentable under 35 U.S.C. §102(e) over Sakai et al. The Examiner's rejection of claims 19 and 20 on these grounds is therefore improper and should be reversed.

9. CONCLUSION

For the above reasons, claims 19 and 20 are not anticipated by Sakai et al.

Therefore, Applicants respectfully submit that the Examiner's rejection of claims 19 and 20 is improper and respectfully requests that the Examiner's rejections of the claims be REVERSED.

Respectfully submitted,

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10. APPENDIX OF CLAIMS ON APPEAL

The text of the claims on appeal is:

19. (Previously Presented) A semiconductor dynamic quantity sensor comprising:

a frame member;

a movable electrode supported by the frame member through a beam portion to be displaced in a displacement direction by a dynamic quantity applied thereto, the movable electrode having a detection surface; and

a fixed electrode supported by the frame member and having a detection surface facing the detection surface of the movable electrode while defining a detection interval that is changed to detect the dynamic quantity when the movable electrode is displaced by the dynamic quantity,

wherein a difference between a first width and a second width of the frame member is 15% or less of a shorter of the first width or the second width.

20. (Previously Presented) A semiconductor dynamic quantity sensor according to claim 19, wherein a difference between a first width and a second width of the frame member is 10% or less of a shorter of the first width or the second width.